4. SPRAY OPERATIONS

4.1 Introduction.

Insecticides have been used in the control of mosquitoes for many years. Insecticides directed against the adult mosquito are commonly applied as residual insecticides, that is the insecticide is sprayed onto the surfaces of the walls of the rooms of houses where it has a prolonged action. The duration of action depends on many factors especially the nature of the surface it is sprayed onto, the insecticide itself and the dose.

An effective insecticide will kill mosquitoes which enter into a house to rest on a sprayed surface by being absorbed by the mosquito through its legs. That is mosquitoes are stopped from surviving long enough for the malaria parasite to develop in the mosquito and also the density (numbers) of the mosquitoes is reduced. These latter two effects will reduce the transmission of malaria from mosquito to man.

4.2 Insecticides

The most common type of insecticide used in the refugee programme has been the organophosphorus (O.P.) compounds, e.g. malathion and fenitrothion.

Malathion is an organophosphorous insecticide of moderate mammalian toxicity. It has been widely used as a residual insecticide where resistance has developed to DDT and other chlorinated hydrocarbon insecticides. The duration of its effect varies according to the surface it is sprayed on; at a dose of 2 g/m2 it can last up to 2-3 months on wood or thatch and up to 4-6 weeks on katcha.

It can be toxic to spraying personnel if proper safety measures are not observed. The common route of absorption is through inhalation or ingestion, or through the intact skin. In the human body it is an indirect inhibitor of the cholinesterase enzyme (refer 4.5 and 4.6).

This insecticide has been used in the refugee programme for a number of years.

Fenitrothion is an organophosphorus insecticide which has proved to be highly effective against the major malaria vectors however it is classified as moderately hazardous and can be toxic to spraymen and workmen handling the insectide unless strict precautionary measures are taken. Its residual effectiveness at 1 g/m2 is slightly longer than malathion being up to 8 weeks, however the insecticide is more expensive.

This insecticide was used in the early 1980's for one or two years and will be reintroduced for limited use in 1990.

4.3 Insecticide Application

The timing of residual spray applications is a crucial factor in obtaining the maximum benefit from spraying. Each insecticide has its specific dosage and spray cycle requirements. Within the refugee programme ideally 2 spray rounds should occur because of the long transmission season in most districts and the short duration of the residual effect of the insecticide. The planning of the rounds including the timing should be based on sound entomological and epidemiological information. The Hudson sprayer or hand compression pump is used to spray the insecticide onto the walls of rooms. Guidelines in english, urdu and pushto have been written on the use and maintenance of these sprayers and are obtainable from UNHCR.

The cultural and behavioural patterns of the people must be considered in the spray plan. The replastering or whitewashing of walls, or rethatching of roofs will result in loss of insecticidal activity. In some cases this is done intentionally to cover the insecticide, for example to remove the odour.

Refugees must be advised to replaster walls prior to spraying and instructed not to replaster or whitewash after spraying for 2 months.

4.4 General principles in planning and implementing.

'Adequate planning, precise execution and sound evaluation are essential elements of a vector control programme if success is to be maintained'. Besides the technical aspects of spraying other factors must be considered such as the mosquito and its behaviour, its susceptibity to insecticides, training of personnel, involvement and motivation of the community and precautions against toxic effects of the insecticides.

Planning: a knowledge of the mosquito and its behaviour is required, for example whether the mosquito rests indoors or outside is important. The susceptibilty of the mosquito to different insecticides is essential to know in determining which insecticide to use.
The estimation of the amount of insecticide required is based on the number, size and type of houses. Accurate maps of the area are helpful. Equipment including protective clothing, gloves and soap should be obtained well in advance of spraying operations.

Spare parts and maintenance: it is essential that adequate attention is paid to the maintenance of the sprayers and to the provision of spareparts. The sprayers should be cleaned after use each day and at the completion of spraying they should be dismantled and oiled for storing until the time of next use.

Training of all involved staff is a necessary part of the programme. Spraymen must receive training in the use and safe handling of insecticides. Refresher courses should also be given each year for experienced spraymen.

Health education: the community should be informed in advance of any spraying operations and their cooperation sought. They should understand why the spraying is occurring and participate during the spraying operation by removing all their furniture, cooking utensils and food before the house is sprayed. In some areas refugees have not allowed spraying to occur in their houses or have replastered the walls after spraying. This leads to ineffective mosquito control. The community health workers, supported by other health personnel should be used to inform the community about the spraying and why it is occurring.

4.5 Safe use of insecticides

Organophosphorus insecticides are toxic and great care must be taken in their use. Appropriate training should be given to all staff.

Principles of hygiene for personal protection. No eating, drinking or smoking should be allowed while handling or spraying insecticides and should only be allowed after washing of hands and face with soap and water. Spillage of insecticide on any part of the body should be washed immediately with soap and water (refer 4.6). At the end of the day a thorough wash with soap and water should be taken.

Protective clothing. Spraymen should wear clean and regularly washed overalls and shoes or boots. Mixers should take extra care and wear gloves in addition to an apron and overalls. They should cover their mouth and nose with a mask.

Monitoring exposure to organophosphorus insecticides. A field test has been developed to monitor cholinesterase levels in field workers. The assays should be performed at regular intervals in all workers who are handling OP insecticides, especially fenitrothion, including before and after the spray round.

4.6 Measures in case of accidental exposure.

If insecticide has been splashed on the skin or eyes it should be washed off by pouring water from a clean container. Washing should continue for at least 5 minutes. Similarly clothing soaked with insecticide should be removed and the skin repeatedly washed with cold water.

Signs of poisoning for malathion and other OP insecticides.
Sweating, tremors, watering of the mouth, tearing of eyes, weakness, giddiness, cramps in stomach, diarrohoea, blurring of vision, narrowing of pupils, exhaustion, vomiting and collapse.

Emergency treatment.
Atropine 2mg is given by mouth or subcutaneously and is to be repeated every 15 minutes if required. Sanitarians should carry atropine and syringes and needles and be able to give first aid until the person can be taken to a B.H.U. or hospital. Persons with respiratory arrest are given artificial respiration. If the person is breathing but unconscious, the contaminated skin is washed and the patient turned on the belly with the head facing to one side. Tranquillizers, barbiturates or other sedatives should not be given. The person should be referred to hospital as soon as he has received emergency treatment.

4.7 Insecticide resistance.

The effective use of DDT and other synthetic insecticides after 1945 resulted in a major reduction in malaria globally and to eradication or near eradication in some countries. However in recent years malaria has increased and resistance to insecticides is considered to be one of the causes. The development of resistance by mosquitoes to insecticides is not uncommon and is one of the main obstacles to their use as the major means of vector control.

It is necessary to test regularly for insecticide resistance. This involves an entomologist catching mosquitoes and then exposing them to the insecticide and counting the number that are killed. If it is considered by the malaria authorities that the resistance is such a level that the insecticide is no longer effective then an alternative insecticide is chosen. However usually the next insecticide is more expensive and sometimes more toxic, for example fenitrothion compared to malathion is more toxic and more expensive.

5. ENVIRONMENTAL MANAGEMENT

5.1 Introduction

Environmental management for vector control is the conducting of activities which prevent or reduce the breeding of mosquito vectors of malaria or reduce the man/malaria vector contact. It includes source reduction, a term used to describe any measure that will prevent or eliminate the breeding of mosquitoes in their natural or man-made habitats. An important man-made breeding site in the Refugee Villages are the pits or depresssions which result from refugees removing soil for building their houses and walls.

In the refugee programme source reduction is of particular importance. The activities or environmental modifications performed commonly include drainage, land filling and levelling.

Source reduction has been used for many years as a vector control measure and when integrated into a malaria control programme has been found to be very effective. When correctly applied and well maintained it has definite advantages, namely it is safe, often cheap to implement, can be effective for years, resources required are limited and there are often side benefits such as improvement in general sanitation.

5.2 Methods.

-Drainage is the removal of unwanted water from the land surface or below it. Drainage for mosquito control should; remove water before mosquitoes have time to develop to adult stage, and dispose of the water without creating a mosquito problem further down the way. Drainage for mosquito control is required before and during the transmission season. Water should not be allowed to remain on the surface for over 5-20 days depending on the temperature. Drainage is usually by the open method and can be dug by hand using pick and shovel. Ditches should tend to be deep and narrow rather than wide and flat.

-Filling of small holes, borrow pits, abandoned ditches, ponds and similar water collections are the measures which provide the longest lasting results. It can be done using handtools, for example shovel and pick and wheel barrows for carrying soil. Land-fills may use sanitary refuse provided that earth is used to cover the fill to prevent fly breeding and smell.

-Basic sanitary measures; the lack of a convenient water supply in a community leads to the stocking of water in tanks, water jars and other containers which may serve as mosquito breeding places. A. stephensi, the probable predominant Anopheline mosquito vector in refugee villages in N.W.F.P. is a domestic species of Anopheles that can breed in containers and tanks or in small seepages and water collections. It is also one of the few Anopheles mosquitoes that can breed in organically polluted water.

-Drying by planting trees is a useful measure where the water table is high. Eucalyptus trees have been widely used for this purpose. The trees dry water logged land by evaporation through their leaves. They should be planted giving adequate space between trees so there is the least interference with evaporation.

5.3 Implementation.

Source reduction is a method of vector control that the community can do if it has an understanding of how and why malaria occurs and why it is necessary to prevent or reduce mosquitoes breeding. Community health workers can play an important role in educating people and should set an example through their own practises (Refer section 7. Health Education). The sanitarian or male outreach worker should have a good understanding of environmental management and in particular source reduction. This may require additional training. He should be responsible in the refugee village for identifying breeding areas of Anopheles mosquitoes (refer Annex 2) and taking appropriate action or motivating the community to take action. This will involve making a thorough reconnaissance of the refugee village. Funds should be available for hiring of labourers and buying of shovels and other equipment if the community is unable to undertake the activity.

5.4 Supervision and monitoring.

Training of sanitarians and sanitation supervisors should occur so that they are familiar with anopheline mosquito breeding habits and with methods of environmental management. They should be able to identify Anopheles larvae and mosquitoes. The supervisors should monitor the activities undertaken in the Refugee Villages.

The entomologist should be available to provide technical advice and he will, over a period of time, build up an entomological profile of Refugee Villages. Unfortunately however, such information is lacking at the present time. The entomologist will also be able to assess environmental management measures undertaken.

6. SELF PROTECTION

6.1 Introduction

Self protection is a malaria control method which individuals may use to reduce the contact between themselves and mosquitoes. Some methods, such as the use of smoke from bark or herbs, date back many centuries. There has been a resurgence of interest in self protection for control of malaria in recent years and there are a number of possible methods that can be used. However for all of the methods it is important to realise that most anopheline mosquitoes bite at night between sunset and dusk.

6.2 Bednets

Bednets remain one of the most important methods for personal protection and in some countries strong traditions for the use of bednets have developed. If used correctly they are effective, however their efficacy can be greatly improved by the use of a repellant or insecticide on the net.

Hanging cots for babies, as used in Pakistan and Afgahanistan, are easy to cover by a piece of netting. But generally Afghans do not have a tradition of using bednets. Their use and acceptance in the refugee setting will be investigated in 1990.

In some health worker curricula, people are advised to wrap themselves in a blanket (patoe). This practise will not stop many mosquitoes from biting and it is better not to give this message in any form of health education.

6.3 Screening of houses.

Screening of house by meshed nylon is practiced by refugee communities and should be encouraged. To be effective it should be total to cover all doors and windows as well as any other opening. Cracks in walls should be sealed.

6.4 House site selection

The type and design of the house and its position relative to mosquito breeding sites and to the direction of the prevailing wind at night time are important factors which can affect the mosquito-man contact. Mosquitoes can be carried some distance by the wind and houses should be built upwind, preferably, to an identified mosquito breeding area.

6.5 Mosquito repellants and anti-mosquito fumigants.

Burning of mosquito coils and leaves from eucalyptus trees are useful to repel mosquitoes. However coils are relatively expensive and hence usually not appropriate for the refugee community.

6.6 Health education

The above measures can be useful malaria control measures in the absence of other control methods or they may supplement other control activities. However their efficacy will depend upon how rigorously and how regularly they are applied. If a measure is to be promoted then the community must be fully informed about it and motivated to adopt it.

7. HEALTH EDUCATION

7.1 Introduction

The need for health education has been mentioned frequently in the preceding guidelines, whether it be for the patient to understand that the complete course of tablets must be taken in order to ensure that the patient is cured or for individuals themselves to adopt measures to prevent themselves from developing malaria. All health workers, whether they be volunteer community health workers or workers based in the clinic should understand the cause of malaria, the measures that can be taken to prevent it, and what should be done when a person has malaria.

7.2 Community knowledge

Two surveys have been conducted in the Afghan refugee villages to assess the refugee's knowledge about the cause of malaria and the methods to prevent malaria. In a survey in Kohat District, NWFP in 1989 among women and men, 66% knew that the mosquito was involved, where as in Pishin District, Balochistan in 1989 surveying women only, 48% knew that mosquitoes were involved. A number of persons thought that malaria was caused by dirty food and water.

In Balochistan, the refugee women were asked about ways to prevent malaria in the family and also in the community. Some 44% knew of a method for the family and 42% for the community. In Kohat only 29% of persons knew of a method to prevent malaria.

The conclusion is that the refugee's knowledge of malaria, its cause and ways to prevent it, is poor.

7.3 Prime messages

A number of prime messages have been developed for health education for malaria control. These messages are considered to be the most important that individuals and communities need to know to prevent malaria or to treat malaria. The messages are;

1. Malaria is transmitted by mosquitoes.
2. Everyone especially children should be protected from mosquito bites especially at night.
3. People should destroy mosquito eggs and prevent mosquitoes from breeding.
4. Mosquitoes can be killed by insecticide spray on walls of houses.
5. Children and adults with a fever should go to the BHU for a blood smear to be taken.
6. If malaria is the cause of the fever, the person must complete the full course of the anti-malarial drugs.

All health workers should be familiar with these messages.

7.4 Communicating the prime messages.

Who in the community should we educate with the health messages?

For malaria we need to educate mothers of children, pregnant women, fathers, school children, community leaders, religious leaders and administration officials. That is the health messages on malaria need to be spread widely throughout the community.

Who should do this?

All health workers have a responsibility to communicate the messages and if other persons such as teachers, religious leaders and administration officials also can communicate the messages this will help greatly in disseminating the information.

A flip chart with a series of pictures which can be used to assist communicating the prime messages to people will be available in 1990.

8. RECORDING AND REPORTING

8.1 The need for accurate recording and reporting.

An effective malaria control programme depends upon accurate recording and reporting. This is both for the patient who suffers from malaria and needs rapid and correct treatment, and for the planning and evaluation of malaria control activities.

Reliable data are used to:

1. Analyse the malaria situation (epidemiology).
2. Plan control measures (for example spraying of insecticides)
3. Evaluate the control measures.

The increasing number of malaria infections over the last years, particularly falciparum malaria, and the development of resistance to chloroquine have made changes in recording and reporting necessary. The changes include monthly reporting of age and sex of the patients, and reporting of the results of follow up slides taken from patients treated for a falciparum infection.

8.2 Recording and reporting.

For persons suspected of having malaria the name, sex and age are recorded in the BHU register along with the daily and monthly number of the slide. The laboratory result is entered in the BHU register when received with F for falciparum malaria, V for vivax malaria and M for mixed vivax and falciparum infections. Also the stages of the parasite as described by the microscopist are recorded, for example t for trophozoite, g for gametocyte, s for schizont. When the patient receives treatment the type of treatment is entered; C for chloroquine, P for primaquine and F for fansidar. The number or proportion of tablets given is also entered (refer example page).

Particular attention should be paid to heavy infections of falciparum malaria, reported as ++++ (more than 10 parasites per high power field) or the presence of schizonts. The laboratory should send the result urgently to the BHU and these patients should receive their treatment as an emergency and be closely monitored.

A patient with malaria may contract the malaria in the refugee village (an indigenous case) or the malaria may have been contracted in another area, for example if the refugee visited Afghanistan or in another area where the person was doing seasonal work. That is the malaria was imported. This information is important as it has major implications for vector control activities. Where possible, if the refugee slept out of the refugee village during the preceding month this information should be recorded.

MALARIA CONTROL GUIDELINES

1. BACKGROUND

1.1 Malaria in Pakistan

Malaria cases occur in all areas of rural inhabited Pakistan with the exception of a few areas, particularly areas of high altitude. The two types of malaria occurring are Plasmodium falciparum and Plasmodium vivax. Both types occur throughout the country but to differing degrees. Falciparum malaria has been more common in the southern and western parts of Pakistan and vivax malaria more common in the northern parts. However in recent years there is a definite trend for falciparum malaria to increase both as a percentage of malaria cases and also in the number of cases.

Prior to 1974, Pakistan operated a malaria eradication programme for 14 years which achieved very impressive results but the low rate of malaria transmission could not be sustained. Since 1974 Pakistan has had a malaria control programme with the strategy being to control malaria to a level whereby death or serious illness would be prevented or reduced, i.e malaria would not pose a public health problem. The programme does not aim at eradicating malaria as this is not considered feasible nor affordable. The control programme is based on case detection and treatment and vector control through insecticide spraying of localities where malaria cases, particularly falciparum cases, have been demonstrated.

1.2 Malaria in Afghan refugees.

Most refugee villages in Pakistan are located in endemic areas for malaria. Afghan refugees in NWFP appear to have a higher rate of malaria than local populations surrounding refugee villages. The reasons for this may be; there are less animals in refugee villages than in Pakistani villages hence mosquitoes in order to obtain a blood meal must feed on humans rather than animals, the environmental changes caused by refugee villages may favour breeding of mosquitoes and the congested nature of the refugee villages with the houses close together increases the probability of being bitten.

1.3 Malaria in Afghanistan.

Malaria is endemic in most parts of Afghanistan. Since 1979 there are reports that the incidence has increased substantially with the disruption or stopping of control activities. Vivax malaria is more common than falciparum however the amount of falciparum malaria has increased in recent years. Chloroquine resistance of falciparum malaria is reported to be an increasing problem.

In addition to the above information, from 1990 the sanitarian or outreach worker has to record in the BHU register whether the slide taken is a follow-up smear. Refer following section.

8.3 Follow-up Smears for Falciparum Malaria.

An efficient system of follow-up slide taking, recording and reporting is necessary to ensure that; patients who fail to respond to standard chloroquine therapy for whatever reason are detected, and to monitor the response of patients with falciparum malaria to chloroquine.

A Follow-up (F.U.) slide is defined as a slide taken from a patient with a P.falciparum infection 1 week to 1 month after treatment. When a patient comes back to the BHU one month or more after treatment with fever then it is possible that the patient has a new infection of malaria and the slide taken is not considered a follow-up slide.

A follow up slide is labeled with a "*" by the sanitarian/ outreach worker. This is to inform the microscopist about the nature of the slide and for them to pay special attention to it.

It is important that every patient with a falciparum infection is asked to return to the BHU for a follow-up smear after one week. The patient should be told on what day to return and it is useful if this date is recorded by the BHU staff. Failure of patients to return on the requested day should be followed up and appropriate action taken to ensure that a slide is obtained. Community health workers can be very helpful in this regard.

A separate column should be made for recording follow-up slides in the BHU register and after the slide has been taken the date should be recorded. A second column should be added to record the full result as in 8.2., for example Ft for falciparum trophozoites and Fg for falciparum gametocytes or -- for a negative smear. Note that gametocytes in a follow-up smear should not be recorded and reported as positive (refer page 7).

8.4 Monthly Reporting

A new monthly reporting form is being developed and will be available in 1990. The form will be divided into 2 parts. The first part will give information on the total number of slides examined (TSE), the number of positive slides for vivax, falciparum, and mixed malaria, the total number of positives (TP), the total number of new patients (TNP), the total number of follow-up slides taken in the previous month (TFU), and the number of positive follow-up slides (TFU+).

In the second part will be recorded the number of positive slides per age group and sex. The age groups will be ; less than 1 yr., 1-4yrs., 5-14yrs. and over 15yrs.

MONTHLY BHU REPORTING FORM FOR MALARIA

MALARIA REPORT FOR THE MONTH ..... 199..

BHU: .....

REFUGEE VILLAGES: ....., ...

DISTRICT: .....

TSE	P.v	P.f	Mix	TP	TFU	TFU+

TOTAL NUMBER OF NEW MALARIA CASES:
..... (TP) - .....(TFU+) = ...

TOTAL NUMBER OF NEW P.f INFECTIONS:
.....(P.f) - .....(TFU+) = ...

FOLLOW UP COVERAGE: .....(TFU) / .....(P.f) + ...(Mixed) x 100% =.....%

FAILED TREATMENT: .....(TFU+) / .....(TFU) x 100% =.....%

Monthly results according age, sex and type of malaria:

	MALE			FEMALE			TOTAL
	P.v	P.f	Mix	P.v	P.f	Mix	
< 1 Yrs							...
1- 4							...
5-14							...
> 15							...
TOTAL	...	...	...	...	...	...	...

Abreviations:
TSE = Total Slides Examined
P.v = P.vivax
P.f = P.falciparum
Mix = Mixed infection
TP = Total slides positive
TFU = Total follow up slides
TFU+= Total follow up ,, positive for trophozoites

MALARIA REPORT FOR THE MONTH April . 1990.

BHU: X.....

REFUGEE VILLAGES: Y ....., ...

DISTRICT: Z.....

TSE	P.v	P.f	Mix	TP	TFU	TFU+
15	2	3	2	7	3	1

TOTAL NUMBER OF NEW MALARIA CASES:
7..... (TP) - 1.....(TFU+) = 6.....

TOTAL NUMBER OF NEW P.f INFECTIONS:
3.... (P.f) - 1.....(TFU+) = 2.....

FOLLOW UP COVERAGE:

$$\frac{3\ldots.(TFU)}{3\ldots..(P.f) + 2\ldots..(Mixed)} \times 100\% = 60\ \%$$

FAILED TREATMENT:

$$\frac{1\ldots.(TFU+)}{3\ldots.(TFU)} \times 100\% = 33\ \%$$

Monthly results according age, sex and type of malaria:

	MALE			FEMALE			TOTAL
	P.v	P.f	Mix	P.v	P.f	Mix	
< 1 Yrs							...
1- 4			1				1
5-14	1						1
> 15	1	2			1	1	5
TOTAL	2	2	1		1	1	7

Abreviations:
TSE = Total Slides Examined
P.v = P.vivax
P.f = P.falciparum
Mix = Mixed infection
TP = Total slides positive
TFU = Total follow up slides
TFU+= Total follow up ,, positive for trophozoites

Monthly results according age, sex and type of malaria:

	MALE			FEMALE			
	P.v	P.f	Mix	P.v	P.f	Mix	TOTAL
< 1 Yrs							
1- 4							
5-14							
> 15							
TOTAL							

AFGHAN REFUGEE HEALTH PROGRAMME, MALARIA REGISTER

District– Z _____ RV:— Y _____ BHU:— X _____ Date:—_____

Sr. No.	Monthly number	Daily number	Name	Age	Sex	Passbook number	Laboratory results			Treatment	FU	FU+
							v	- m	f			
	351	1	PATIENT A	20	M				Ftg	C4 C3 C3 P6		
	352	2	B	6	M		Vtg			C2 C1½ C1½ P½ P½ P½ P½ P½		
	353	3	C	1	M			Vt Ftg		C½ C¼ C¼		
	354	4	D	12	F						*	(Fg)
	355	5	E	30	F				Ftg	C4 C3 C3 C3 C3 P6	*	+
	356	6	F	2	M		—		—			
	357	7	G	45	M		—		—			
	358	8	H	60	M		Vt			C4 C3 C3 P2 P2 P2 P2 P2		
	359	9	I	16	M				Ftg	C4 C3 C3 P6		
	360	10	J	25	F			Vt Ftg		C4 C3 C3 P2 P2 P2 P2 P2		
	361	11	K	16	F		—		—			
	362	12	L	19	M		—		—		*	(Fg)
	363	13	M	2	M		—		—			
	364	14	N	48	F		—		—			
	365	15	O	10	M		—		—			

Form AR 14

BLOOD SMEAR PREPARATION

1. When to prepare a smear.

It is a persistent misunderstanding that blood smears should be be taken only when the patient suffers from a fever attack. Although there may be more parasites in the blood during a fever period, a person suspected of having malaria can be examined reliably at any time. Postponing the taking of a smear in a suspected malaria case is not acceptable.
Slides should be prepared before anti malaria treatment is given, since a low grade infection can be obscured with a single dose of an anti-malarial drug.

2. How to prepare a smear

A properly prepared smear is required for a reliable diagnosis, and will save the microscopist time in examining the smear. The standard WHO method for slide preparation from capillary blood is described in detail on the next pages. When venous blood is used, avoid the use of heparin as an anticoagulant.
Attention should be paid to the following points.

1. Clean the finger with spirit and than remove spirit from the finger with clean piece of cotton wool (Failure to do this may result in fixation of the thick smear).
2. Use a sterile blood lancet.
3. Remove the first drop of blood with a clean piece of cotton.
4. Always use a clean slide for smear preparation.
5. Handle the slides only by the edges to avoid finger prints on the slide.
6. Only touch the drop of blood, and not the finger of the patient with the slide.
7. Let the slide dry in a flat position, and cover to protect it from dust and flies.
8. Label the slide as soon as possible. Do not write on the top of the thin film, because this area is used for examination.
9. Mark a follow up up smear with an "*".

3. Cleaning and sterilization of blood lancets

The use of clean blood lancets is of paramount importance to prevent cross-infection of malaria, hepatitis and AIDS.

Collect the blood lancets in a separate well marked box after use.

Sterilize the batch of used blood lancets in the BHU in the following way:

1. Soak the lancets in water with a detergent for a few hours.

2. Remove all dirt by rubbing the lancets individually.
3. Rinse all lancets together with clean water 3 times.
4. Put the lancets in a boiling pan or tray and cover them with at least 2 cm clean water. Put a lid on the pan.
5. Heat the pan. When the water boils start the timer.
6. Boil the water for at least 20 minutes.
7. Carefully pour out all hot water.
8. Put the slides in a plastic or metal box, that can be covered with a lid.

Note: Hypodermic needles should not be used for blood smear preparation. Dirt collects in the needle which is difficult to remove.

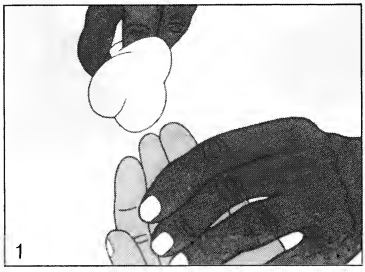
WHO SECRETARIAT FOR THE COORDINATION OF MALARIA TRAINING IN ASIA AND THE PACIFIC

For routine malaria microscopy a thin and a thick film are made on the same slide. The thin film is used as a label but, if well prepared, is also available for species confirmation. Examination should be done on the thick film.

Items needed for making blood films

- cleaned, wrapped slides
- sterile lancets (not hypodermic needles or lancets soaked only in alcohol)
- 70% methanol
- absorbent cotton wool
- clean, lint-free, cotton towel
- slide box or cover to protect drying blood films
- soft lead pencil
- register or record form
- ball pen

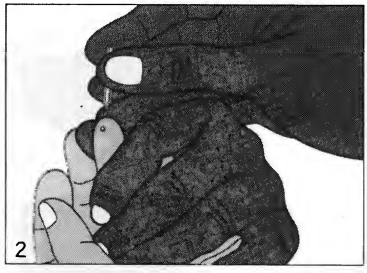
After patient information has been recorded in the appropriate form or register, the blood films are made as follows:



1. With the patient's left hand, palm upwards, select the third finger from the thumb. (The big toe can be used with infants. The thumb should never be used for adults or children).

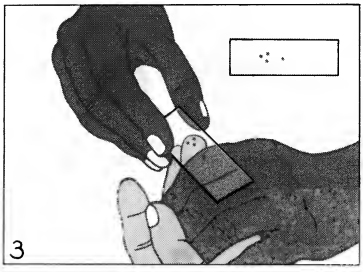
— With a pledget of cotton wool lightly soaked in alcohol clean the finger, using firm strokes to remove dirt and grease from the ball of the finger.

—With the clean cotton towel dry the finger, using firm strokes to stimulate blood circulation.



2. With a sterile lancet puncture the ball of the finger using a quick rolling action.

— By applying gentle pressure to the finger express the first drop of blood and wipe it away with a dry pledget of cotton wool. Make sure no strands of cotton remain on the finger to be later mixed with the blood.



3. Working quickly and handling clean slides only by the edges, collect the blood as follows:

— Apply gentle pressure to the finger and collect a single small drop of blood, about this size ●, on to the middle of the slide. This is for the thin film.

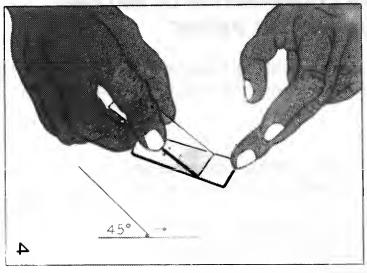
— Apply further pressure to express more blood and collect two or three larger drops, about this size ●, on to the slide about 1 cm from the drop intended for the thin film as illustrated.

— Wipe the remaining blood away from the finger with a pledget of cotton wool.

AIDS TO HUMAN MALARIA DIAGNOSIS 5

PREPARATION OF A THICK AND THIN BLOOD FILM ON THE SAME SLIDE

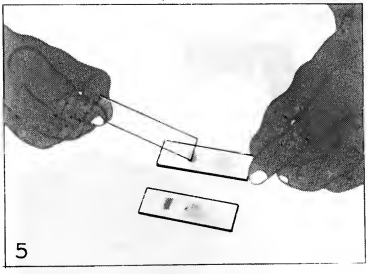
(Original illustrations by Yap Loy Fong)

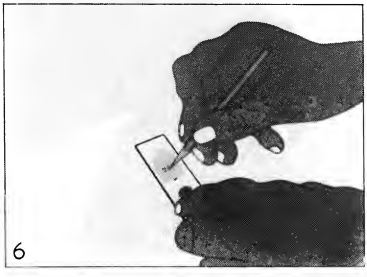


4. Thin film. Using another clean slide as a "spreader" and with the slide with the blood drops resting on a flat, firm surface, touch the small drop with the spreader and allow the blood to run along its edge. Firmly push the spreader along the slide, keeping the spreader at an angle of 45°. Make sure the spreader is in even contact with the surface of the slide all the time the blood is being spread.

5. Thick film. Always handle slides by the edges or by a corner to make the thick film as follows:

— Using the corner of the spreader quickly join the drops of blood and spread them to make an even, thick film. The blood should not be excessively stirred but can be spread in a circular or rectangular form with 3 to 6 movements.

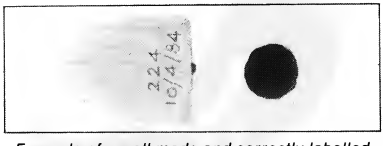




6. Label the dry thin film with the soft lead pencil by writing across the thicker portion of the film the patient's name or number and date. Do not use the ball pen for labelling the slide. Allow the thick film to dry in a flat, level position protected from flies, dust and extreme heat.

7. Wrap the dry slide in the patient's record form and dispatch to the laboratory as soon as possible.

8. The slide used for spreading the blood films may now be used for the next patient and another clean slide from the pack will be used as a spreader.



Example of a well made and correctly labelled thick and thin film.

Printed by Art Printing Works Sdn. Bhd., 29 Jalan Riong, Kuala Lumpur, Malaysia.

IDENTIFICATION OF MALARIA VECTOR MOSQUITOES BY HEALTH CARE WORKERS IN PAKISTAN (LARVA AND ADULT)

The malaria parasite can only be transmitted by mosquitoes of one family: Anopheline mosquitoes. There are many different members (species) in this family, some of which are suitable hosts for the malaria parasite. Families of mosquitoes share characteristics that can be easily observed.

LARVA.

Part of the lifecycle of the mosquito takes place in the water (egg, larva and pupa). Larva are small "wriggling" creatures, between 1 and 6 mm, depending on the larval stage.

The Anopheline larva feeds and hides under the water surface. When it comes to the surface to breath, it floats **horizontally.**
There is no tube visible. The anopheles larva has a hole (SPIRACLE) through which it breathes (See drawing).

The Culicine larva does not float horizontally as the Anopheles, but makes an angle with the water surface. See drawing.
The culicine larva has an easily visible tube **(SYPHON)**, touching the surface, through which it breathes. The syphon is visible at the rear end of the larva.

(The syphon of the Culex and the spiracle of the Anopheles larva will be blocked when oil is spread over the water surface).

ADULT

Spotted wings are the most useful feature to recognize the Anopheles malaria mosquito for health workers in Pakistan.
However, there are some mosquitoes of the Culicine family which have spotted wings (Aedes), and some Anopheline species which have no spots.

The **resting position** of the adult (see picture) is not always conclusive. In Pakistan one of the Anopheles vectors rests horizontally, identical with the Culicine mosquitoes.
This means that a mosquito resting at an angle on the wall is an Anopheles mosquito, but those resting horizontally can be either an Anopheles or a Culex mosquito.

See illustrations on next page:

2. MALARIA CONTROL

2.1 Principles of control.

The basic objective of malaria control is to reduce the transmission of malaria by the mosquito vector to a level where the infections no longer cause death nor are able to cause excessive sickness in a community. Transmission of malaria requires the presence of malaria carriers (people infected with malaria), the presence of the vector (anopheline mosquitoes) and favourable climatic conditions of temperature and humidity for the mosquito.

There are 5 basic approaches to the control of malaria:

1. Diagnosis and treatment-attack on the malaria parasite in the human host.
2. Vector control-attack on the adult mosquito.
3. Self protection-reduction of contact between humans and mosquitoes.
4. Environmental management-elimination or reduction of mosquito breeding sites.
5. Larval control-attack on the early (water) stages of the mosquito usually by chemical larvicides.

2.2 Organization of malaria control.

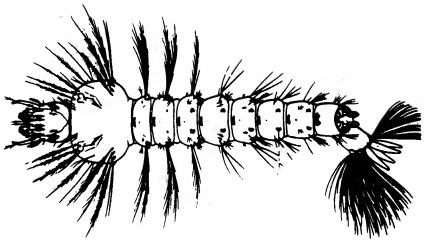
The malaria control programme is fully integrated into the overall health care programme. All the health workers, including FSMOs, MOs, LHVs,dispensers, sanitarians, outreach workers, microscopists and community health supervisors and workers have key roles in the implementation of the programme. The previous programme of having a few workers only responsible for malaria control is not appropriate in a primary health care programme.

The malaria control programme consists of many activities; health education, early detection, referral to the BHU, diagnosis, case treatment, follow-up, insecticide spraying, reduction of breeding sites for mosquitoes and monitoring and evaluation of the programme. Health workers must work together closely with timely and efficient sharing of information if the programme is to work effectively.

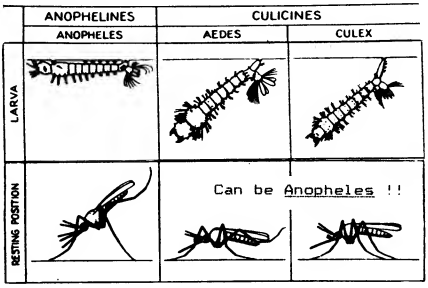
IDENTIFICATION OF MALARIA VECTOR MOSQUITOES BY HEALTH CARE WORKERS IN PAKISTAN

Pictures taken from ESSENTIAL MALARIOLOGY
L.J. BRUCE-CHWATT, 1985

THE ADULT ANOPHELES VECTOR
Note the spotted wings. (See arrow)
Most Culicine mosquitoes have brown shiny wings without spots.



THE ANOPHELES LARVA
Note there is no tube (syphon) visible at the rear end of the larva. The hole through which the larva respires (**spiracle**) is not visible with the naked eye.



Syphon (tube) in Culicine larva, (See arrow).
Not present in the carriers of malaria.

In Pakistan mosquitoes resting horizontally can be Culicine or Anopheles mosqitoes

Mosquitoes resting at an angle are Anopheles mosquitoes.

MALARIA MICROSCOPY GUIDELINES

MALARIA CONTROL PROGRAMME FOR AFGHAN REFUGEES

REFERRAL LABORATORY FOR MALARIA

M. J. BOUMA MSF-H/B (Project Manager)
NAEEM DURRANI PDH/UNHCR (Laboratory Manager)

Literature used:

1. WHO: **bench aids for the diagnosis of malaria.**
2. TEACHING AIDS AT LOW COST (TALC):**Bench aid Malaria.**
3. London School of Hygiene & Tropical medicine instruction sheets for students in parasitology.
4. L. J. Bruce-Chwatt, **ESSENTIAL MALARIOLOGY,** 1985.
5. Wernsdorfer & McGregor **MALARIA,** 1988.

GUIDELINES MALARIA MICROSCOPY

1. GENERAL SAFETY PRINCIPLES FOR FIELD LABORATORIES

1) The laboratory should not be entered by other persons than the laboratory staff.
2) Coats must be worn in the laboratory Before leaving the laboratory, the coat is removed and the hands washed.
3) Eating, drinking and smoking in the laboratory is not permitted.
4) Every laboratory should have a first aid box, and at least one staff member must be able to provide first aid.

2. COLLECTION OF BLOOD SAMPLES

Proper preparation of blood smears improves the reliability of the microscopic diagnosis, and can save the microscopist examination time. Although blood smears are usually made in the BHU by a malaria supervisor, microscopists must be able to prepare slides to enable them to give feedback to the malaria supervisor when slides are not prepared satisfactorily.

The procedure for the collection of blood samples is described under guidelines for BHU staff.

Thick and thin smears

For routine malaria microscopy a thick and a thin smear are made on the same glass slide. Both thick and thin smears are required for reliable malaria microscopy.
The **thick film** is the most reliable way to diagnose the presence of a malaria infection. Because this method concentrates parasites, it facilitates detecting malaria.
The **thin film** is important for a reliable species diagnosis (P. falciparum or P. vivax). This is because the parasites can be better observed in the red blood cells that are preserved after fixation. For dirty slides and for inexperienced microscopists, when the thick smear is not conclusive, the thin smear with its clear features of the malaria parasite, will help to make a reliable diagnosis.
The thin smear is also used to:

* labeling the smear
* a differential count of White Blood Cells/morphology RBC's.

The combination of a thick and a properly prepared thin blood film is a powerful tool in the evaluation and treatment of fever.

3. PROCEDURES FOR PROCESSING OF MALARIA SLIDES

3.1 Fixation

To prevent loss of the thin smear during staining, the thin smear has to be fixed.
Methanol is recommended for this, but spirit can be used when methanol is not available.

.../3.

Fixation should be done very carefully, because contact of methanol with the thick smear will spoil the smear.

1) Dip the slide with the thin smear in a small container with methanol for a few seconds.
2) Place the slide vertical in a drying rack, with the thin smear under, to prevent traces of methanol reaching the thick smear.
3) For an optimal thin smear, the slide is submerged in the Giemsa solution before the methanol has dried.

Fixation for 30 seconds, recommended in some books is not necessary, and will increase the chances of spoiling the thick smear with methanol vapour.

3.2 Preparation of Giemsa stock solution

It is preferred that the microscopist makes up his own stock solution of Giemsa. This is more reliable than buying ready made stock solution which is often of poor quality and more expensive.

Requirements:

.Giemsa stain powder	= 3.8 grams	.Mixer (Electric)
.Methyl alcohon	= 250 ml	.Weighing Scale
.Glycerol	= 250 ml	.Label
.Graduated Cylinders		.Funnel
.Empty Coloured bottle		.Filter Paper

Procedure:

1. Make sure that all equipment to be used is thoroughly clean and dry.
   Weight 3.8 grams of giemsa powder, and put it in the mixer.
2. Measure 250 ml of glycerol in cylinder 1.
3. Take 250 ml of methanol in cylinder 2.
4. Pour 125 ml of glycerol and 125 ml of methanol in mixer machine from cylinders 1 and 2.
5. Run the mixer slowly for 3 minutes.
6. Pour the remaining glycerol from cylinder 1 in the mixer.
7. Pour half (60 ml) of the remaining methanol (cylinder 2) in cylinder 1, rinse the cylinder to remove traces of glycerol and add this volume to the content of the mixer.
8. Run the mixer again for 5 minutes.
9. Pour the stock solution into a clean and dry coloured bottle.
10. Pour remaining methanol (65 ml) from cylinder into the mixer, run the machine for a few seconds to clean the mixer and remove traces of stock solution, and pour the remaining volume into the bottle with the stock solution. Shake the bottle.
11. Label the bottle (Content and date of preparation).

.../4.

When an electric mixer is not available, Giemsa stock solution can be prepared with:

- Glass beads (or glass pieces from a broken car window)
- Hard glass bottle

Procedure:

1. Place about 50 glass beads (3-5 mm diameter) in a hard glass bottle with tightly fitting stopper. Use only dry equipment.
2. Pour the glycerol into the bottle, using a glass funnel.
3. Place the giemsa powder in the funnel and flush the powder into the bottle by slowly pouring the methanol through the funnel.
4. Place the stopper tightly on the bottle.
5. Shake the solution quite vigorously for 5 minutes each day for the following three days.
6. The stock solution can be used 24 hours after the last shaking.
7. Label the bottle (Content and date of preparation).

Testing of stock solution

After the preparation of the stock solution as described above, the prepared solution is tested on a few fresh slides, preferably on a known positive smear (not from a new patient specimen that cannot be replaced).

Filtration of stock solution

When results of staining are not satisfactory, particularly when undissolved particles or sediments are seen during staining, the stock solution should filtered.
Pour the stock solution through a funnel with a folded piece of filter paper into a second clean and dry bottle.

Maintenance of stock solution

1. Store the stock solution in a dark place.
2. Make sure that the bottle is carefully closed after use.
3. Make sure that water never comes in contact with the stock solution, as this will spoil it. For this reason diluted stain should never be poured back into the stock solution (material to prepare the stock solution should be carefully dried before the preparation).

.../5.

3.3 Diluting the stock solution

Before the Giemsa stock solution can be used for staining slides, the solution has to be diluted with water.

The diluted Giemsa solution can only be used on the day of preparation. The solution is discarded after the working day. It should never be poured back into the bottle with stock solution.

To limit wasting of stock solution it should be attempted to prepare staining solution according to the amount of slides to be stained. For routine use in field laboratories a **4% dilution** is prepared.

	Stock solution	Water
To prepare 100 ml. of solution:	4 ml.	96 ml.
50 ml.	2 ml.	48 ml.
25 ml.	1 ml.	24 ml.

Small amounts of Giemsa stock solution can be reliably measured with a 5 ml syringe and a blunted needle. A calibrated cylinder is used to measure the amount of water.

In case only a few slides which require quick examination have to be stained, (e.g when patients are waiting for their lab results) a **10% solution** can be prepared in a 10 ml. syringe.
This is sufficient for 3 to 4 slides.

1. 1 ml of giemsa stock solution is aspirated with a blunted needle from the stock solution.
2. 9 ml of water is aspirated with the same needle.
3. The solution is mixed with a bubble of air by inverting the syringe a few times.

Buffered water (distilled)

To obtain optimal results, distilled water with a pH of 7.2 is recommended for the dilution. However, in most places in Pakistan, the pH of the tapwater approaches 7.2, and ordinary tap water gives acceptable results without buffering.
The easiest way to check the pH of the water is with special PH paper (range 6 - 8).
When the pH is less than 7, correction of the pH of the water is required. Using water with an unsuitable pH leads to loss of important features of the malaria parasite (e.g. Stippling in P. vivax).
To rectify the pH of the water, special buffer tablets are available. These are expensive. A mixture of the following ingredients can be prepared to obtain water with the right pH:
Buffering of water. Dissolve:

Di-sodium hydrogen phosphate Na2HP04 (Anhydrous)	:	1 gram
(When anhydrous form is not available Na2P04.12H20	:	2 gram)
Potassium di-hydrogen phosphate KH2P04 (anhydrous)	:	0.7 gram
in water (distilled)		1000 ml.

..../6.

3.4 Staining of slides

Slides should be processed as soon as possible on behalf of the patient, and also because slides may become unreadable. After a few days under the climatological conditions in Pakistan the blood smears will become fixed (auto-fixation), and particularly the thick film will be lost.
When the slide is stained within 12 hours of smear preparation, the thick film is not yet firmly attached to the glass, and great care has to be taken not to flush it from the slide during staining.

Staining methods
Trays are available for staining 20 or more slides. Slides should be put in pairs, back to back in the slits of a tray, to prevent damage to the smears.

When a few slides are stained it is more cost effective to make a small amount of Giemsa solution (See syringe method as described above). Slides can be placed on a horizontal surface, face up (two glass rods laid over the sink in the horizontal position). Slides can be flooded with staining solution from the syringe.

Staining time
The staining time depends on the dilution and on the quality of the Giemsa powder with which the stock solution is prepared.
The following guidelines are based on Giemsa powder of good quality. When slides are insufficiently stained with the recommended dilution, a higher concentration of stock solution has to be used.

4 % solution: 30 - 35 minutes.
10% " : 10 - 15 minutes.

When slides appear to be under stained (see evaluation of staining), staining can be prolonged.

Procedure Staining tray:

1. Place slides in pairs, back to back in the tray.
2. Add a 4% diluted giemsa solution, and stain for 35 minutes.
3. After removing the scum, gently pour the staining solution into another tray (although not recommended, sometimes the solution is used a second time).
4. Remove the slides from the tray and rinse them gently by dipping them in a beaker of clean water, until no stain is released from the slide.
5. Let the slides dry on a drying rack, face down to prevent them from getting dusty.

..../7.

3.5 Evaluation of staining.

Slides after staining should be free of debris deposits. When these deposits are seen, the stock solution has to be filtered (See above).

Thick smear: the nuclei of WBCs are deep purple.
Malaria parasites have a dark red chromatin dot, and a bluish cytoplasm. When colours are faint, staining of the batch can be prolonged until slides are sufficiently coloured. In the owing batch more stock solution has to be used to prepare the staining solution.

Thin smear: the colour of erythrocytes should be greyish pink.
When rbc's are red-orange, the ph of water used for staining was too acidic (Low PH). Shuffner dots in P. vivax will not be visible in this condition.
When the erythrocytes are dark blue, the pH of the water used was too alkaline (pH too high). Usually thin smears require longer staining than thick smears. When both smears are on one slide and stained (for the same period), colours in the thin smear will be lighter than in the thick smear.
Problems with staining should be reported as soon as possible to laboratory dispenser and F.S.M.O.

4. MICROSCOPY

Examine at least 100 fields under the oil emersion lens (700 - 1000 x) before a slide is declared negative. The time required for careful examination of 100 fields depends on the experience of the microscopist. It may vary between 3 minutes for an experienced microscopist to 10 minutes for an inexperienced microscopist. When malaria parasites are seen or suspected in the thick smear, switch to the thin film. Examine the top of the thin smear where red blood cells do not overlap.
Do not make species diagnosis before a number of parasitized RBCs have been seen.

Level of parasitemia
In case P. falciparum is diagnosed, an estimation of parasitemia should be made.

```
    + = 1 ---10 parasites/100 thick film fields
   ++ = 11 --100  "   "     "    "    "      "
  +++ = 1 ---10   "      /  1 thick film field.
 ++++ = More than 10 parasite/ 1 thick film field.
```

Follow up slide
A follow up slide, marked with an "*" by the malaria supervisor needs special attention from the microscopist. When the slide is reported as Fg, that is falciparum gametocytes only present the slide is regarded as negative, and the patient will not be treated. The microscopist before reporting Fg, should be sure he has checked the slide thoroughly for trophozoites. At least 200 fields or 5 minutes should be spent before a slide can be declared as Fg or negative.

.../8.

5. CLEANING OF SLIDES FOR REUSE

If malaria slides are labelled with a lead pencil (not with a diamond pencil), they can be washed and reused. The number of times the slides can be used depends on the care taken with the slides. An average of 5 times is acceptable.
Grease and (immersion) oil and dirt will spoil a smear taken with a poorly cleaned slide. The following procedure has to be followed:

1) Discard scratched slides.
2) Place the used slides carefully in a basin with water and a detergent (Soap) for 1 or 2 days. This soaking time can be reduced by boiling the slides in the detergent solution.
3) Transfer the slides to a fresh solution of detergent.
4) Rub the slides individually with a soft piece of cotton cloth to remove all traces of the old smears.
5) Rinse them in clean water.
6) Dry the slides by leaving them in the air.
7) Polish the slides with a clean piece of cotton cloth.
8) Store them in a box or wrap the slides carefully to protect them from scratching and dust.

6. RECORDING & REPORTING

In the "positive" register of the laboratory all cases of malaria are recorded by species and stages of the parasite. Similar to the BHU register, 2 additional columns for Follow Up slides (FU) and Follow UP Positives (FU+) should be added to the current register.

6.1 Reporting time

Time between slide taking and treatment should be minimized. Reporting time can be reduced by processing and examination of the slides in the afternoon, after the BHU has closed. This will mean that the results can reach the BHU the next day.

6.2 Species and stages of the parasite

Species and stages trophozoites, schizonts and gametocytes) should be reported to the BHU. The type of treatment will depend on species and stage reported.
Reporting of the stage is particularly important in the follow up smear after treatment of a P. falciparum infection.
Gametocytes of P. falciparum can circulate for a few weeks after successful treatment. This does not indicate failure of treatment. When trophozoites are not found, the patient will not be treated again.

6.3 Density of P. falciparum infection

When more than 10 parasites per field are seen (++++), the should be reported to the BHU as soon as possible. A parasitemia of this level in an untreated patient is life threatening.

.../9.

7. LABORATORY SUPERVISION AND QUALITY CONTROL OF MICROSCOPY

A supervision system of field laboratories is a essential for every malaria programme. This is to assist the field staff in solving technical and diagnostic problems, and to maintain the standard of microscopy.

7.1 Storing slides for cross-checking

On the monthly visits of the laboratory supervisor, a proportion of the negative and positive slides are collected for cross-checking in the referral laboratory.

* 5 - 10 % of the Pv slides are collected
* 5 - 10 % of all negative slides are collected
* All Pf slides, mixed infections and follow up slides are collected.

The sample of negative and Pv slides is randomly selected. To facilitate the supervisor in the collection of the slides for cross-examination, slides must be stores separately.
The slide store box should have a section for Pv slides, a section for Pf and FU slides combined.
The negative slides of every day are wrapped in a piece of paper on which the date is written, and stored in a carton box.

After the visit of the laboratory supervisor, all slides examined during the previous month are removed from the boxes and washed for re-use.

7.2 Feed back on wrongly reported slides.

In the referral laboratory, the slides collected from the field are examined for staining and correct diagnosis.
Mistakes in the diagnosis and poor staining quality are reported back to the field microscopist on the next field visit of the supervisor. These slides with the mistaken diagnosis are shown to the field microscopist and explained by the supervisor.

3. DIAGNOSIS AND TREATMENT.

3.1 Diagnosis.

It is important that patients with fever suspected of being due to malaria are referred to the BHU as early as possible for confirmation of the diagnosis and starting of treatment. Community health workers, both male and female, have an important role in informing the community about the signs and symptoms of malaria and the need for a malaria slide to be taken to confirm the diagnosis before starting treatment (Refer section 7.Health Education). They should ensure early referral of suspected cases to the BHU.

At the BHU or SHU a malaria slide should be taken from all suspected malaria cases (refer Annex 2). A sterile lancet should be used; either a new lancet or one resterilized. On the spot microscopic examination is by far the most preferable and should be done if at all possible. If it can not be done, and this is the situation for most BHUs, then the slides should be transported daily to the laboratory and the result of the microscopic examination should be returned to the clinic within 24 hours, if at all possible, so that positive cases can commence quickly the full treatment for their malaria.

Falciparum malaria is the most serious form of malaria and may present in an atypical manner particularly in children and pregnant women, who are both more prone to infection and to the complications of infection. Children may present with diarrhoea and fever or symptoms of a respiratory infection and a high suspicion of malaria is necessary. Pregnant women attending antenatal clinics should be asked about fever and a malaria slide should be taken if there is a history of fever or a history of a positive malaria case in her compound recently.

Cerebral malaria commonly causes death if effective treatment is not commenced early, hence it is necessary to have a high index of suspicion for this condition. Signs and symptoms include headache, stiff neck, fits, disorientation, drowsiness and coma.

3.2. Presumptive treatment

Every person suspected of having malaria attending the BHU is given a single dose of chloroquine 10mg. base/kg body weight* after a blood specimen has been taken for laboratory examination. Primaquine is not given.

* Treatment dosages are given for both body weight and age. Since weigh scales are often not available, treatment by age is usually more convenient.

ANNEX 4

LIST OF RELATED GUIDELINES AND MATERIALS.

1. Guidelines for environmental health services for Afghan refugees in Pakistan. (English) C.C.A.R./U.N.H.C.R. 1989.

2. Health education guidelines. (English) C.C.A.R./U.N.H.C.R. 1989.

3. Manual for operation and maintenance of the Hudson sprayer. (English, Urdu, Pushto) C.C.A.R./U.N.H.C.R. 1988.

4. Bench aids for the diagnosis of malaria. World Health Organization, Geneva.

5. Bench aid malaria : Teaching Aids at Low Cost (TALC)

PRESUMPTIVE TREATMENT

Age group	Number of chloroquine tablets (150 mg base)
1-11 months	1/4 tablet
12-24 months	1/2 tablet
3-4 years	1 tablet
5-6 years	2 tablets
7-14 years	3 tablets
15+ years	4 tablets

3.3 Radical treatment.

If the laboratory results confirm the diagnosis of either vivax or falciparum malaria then the presumptive treatment of chloroquine 10 mg base/kg given in all suspected cases is not sufficient for cure. Every confirmed case of vivax or falciparum malaria must be given radical treatment which is a combination of chloroquine and primaquine.

If there is a gap of greater than 24 hours after the presumptive treatment has been given then the full course of treatment should be given, that is give the day 1 or presumptive treatment again.

3.4 Treatment of vivax malaria

Chloroquine: total dose - 25 mg base/kg. body weight given over 48 hours.

Distribution of total dose
10 mg/kg at 0 hours
7.5 mg/kg at 24 hours
7.5 mg/kg at 48 hours

Primaquine: total dose - 0.25 mg base/kg body weight daily for 5 days.

Distribution of total dose
0.25 mg/kg on day 1
0.25 mg/kg on day 2
0.25 mg/kg on day 3
0.25 mg/kg on day 4
0.25 mg/kg on day 5

Primaquine should not be administered for more than 5 days to Afghans since G6PD deficiency is common in Afghans and administration of primaquine for longer periods may result in life-threatening hemolysis.

TREATMENT VIVAX MALARIA

By age, C=1 represents 1 tablet of chloroquine 150 mg base,
P=1 represents 1 tablet of primaquine 7.5 mg.

Day of Treatment

Age Groups	1	2	3	4	5
1-11 months	C=1/4	C=1/8	C=1/8		
12-24 months	C=1/2	C=1/4	C=1/4		
3-4 years	C=1 P=1/4	C=3/4 P=1/4	C=3/4 P=1/4	P=1/4	P=1/4
5-6 years	C=2 P=1/2	C=1,1/2 P=1/2	C=1,1/2 P=1/2	P=1/2	P=1/2
7-14 years	C=3 P=1	C=2,1/4 P=1	C=2,1/4 P=1	P=1	P=1
15+ years	C=4 P=2	C=3 P=2	C=3 P=2	P=2	P=2

3.5 Treatment of falciparum malaria

The standard treatment for falciparum malaria follows;

Chloroquine: total dose - 25 mg base/kg body weight given over 48 hours.

Distribution of total dose
10 mg/kg at 0 hours
7.5 mg/kg at 24 hours
7.5 mg/kg at 48 hours

Primaquine: total dose - 0.5 mg/kg body weight in one dose. For a 60kg adult give 30mg (4 tablets 7.5mg).

Distribution of total dose
0.5 mg/kg on day 1

The first dose of chloroquine and the primaquine can be swallowed by the patient under the direct supervision of a health worker.

The reason for use of primaquine in falciparum malaria is that it kills the P. falciparum gametocytes in the blood and helps reduce transmission of malaria from treated patients. It does not help to cure falciparum infection in an individual patient.

TREATMENT FALCIPARUM MALARIA

By age, C=1 represents 1 tablet chloroquine 150 mg base,
P=1 represents 1 tablet primaquine 7.5 mg.

Age Group	Day 1	Day 2	Day 3
1 - 11 months	C=1/4	C=1/8	C=1/8
12 - 24 months	C=1/2	C= 1/4	C=1/4
3 - 4 years	C= 1 P= 3/4	C= 3/4	C= 3/4
5 - 6 years	C= 2 P=1,1/2	C=1,1/2	C=1,1/2
7 - 14 years	C= 3 P= 3	C=2,1/4	C=2,1/4
15 + years	C= 4 P= 4	C= 3	C= 3

Note children below 2 years of age and pregnant women should not receive primaquine.

Particular attention should be paid to heavy infections of falciparum malaria, which are reported by the microscopist as ++++ (more than 10 parasites per high power field) or the presence of schizonts. These patients require treatment urgently and should be closely monitored for their response.

Treatment and follow up of falciparum cases must be given high priority. Some patients are not cured by treatment, either because they did not take all the tablets or because the malaria parasite has a degree of resistance against the chloroquine. A follow-up smear at one week after starting treatment must be taken. The patient should be asked to return to the clinic for a blood smear. If the patient fails to return then the sanitarian/ outreach worker or another health worker should visit the patient and take a blood smear.

When a person is diagnosed as falciparum malaria then blood smears should be taken from any persons with fever or a history of fever within the last month that live in the same compound as the patient .

3.6 Chloroquine resistant falciparum malaria

In Pakistan and neighbouring countries cases of falciparum malaria which are resistant or partially resistant to chloroquine are occurring more frequently. This is a very serious development as chloroquine, because of its low cost, ready availability and its great efficacy in falciparum malaria has been the most important and most widely used drug in the treatment of malaria.

After radical treatment with chloroquine the falciparum parasites may respond in 2 different ways:

1) Sensitive: Following treatment the blood smears become negative for malaria parasites with the exception that some gametocytes may be seen for upto 3 weeks. The blood smear remains negative and the patient is cured.

2) Resistant: Following treatment blood smears may become negative for a period but become positive again within 1 month or the blood smears may remain positive continuously, that is trophozoites are seen.

A blood smear taken 7 days after commencing radical treatment will identify many patients who fail to respond to chloroquine. In addition all patients should be advised that if they develop a fever they should return for a blood smear.

If a repeat blood smear examination at 1 week or within 1 month is positive for P. falciparum malaria then infection with a chloroquine resistant strain should be suspected. However a common cause of recurrence of a positive smear is failure to take the full course of chloroquine. A second course of radical treatment should be given with the chloroquine being given for 5 days (total dose of chloroquine 40mg base/kg body weight) with close follow up of the patient and clear instructions to the patient on the need to take the full course of treatment. A repeat blood smear must be taken after 7 and 28 days. Reinfection before 28 days is possible but cannot be differentiated from relapse.

If the patient continues to have a positive smear for P. falciparum after a second course of chloroquine and primaquine, with trophozoites being seen after retreatment, (the presence of gametocytes for some days after treatment is a normal occurrence and does not indicate failure of therapy) then sulfadoxine/pyrimethamine (fansidar) should be given;

The dose is sulfadoxine-pyrimethamine 25 mg/kg and 1.25 mg/kg

For a 60 kg adult the dose is sulfadoxine 1500 mg / pyrimethamine 75 mg that is Fansidar 3 tablets.

For children 11-14 years 2 tablets.
4-10 years 1 tablet.
1-3 years 1/2 tablet.
Less than 1 year not recommended.

Reactions to the sulfadoxine component are not uncommon.

Blood smears should be taken at 7 and 28 days.

Vivax malaria is not very sensitive to Fansidar and this combination of drugs should not be used for its treatment. There is no resistance of vivax malaria to chloroquine.

CHART

Management of a patient with suspected malaria.

-Patient referred to BHU or SHU.
-Take blood smear.
-Give presumptive treatment:
Chloroquine one dose.
Refer page 3.

Smear -ve

No further treatment.

Smear +ve : P.vivax

Radical treatment :
Refer page 5
Chloroquine for 3 days
Primaquine for 5 days

Smear +ve : P.falciparum

Radical treatment :
Refer page 6
Chloroquine for 3 days
Primaquine one dose

Take blood smear at 7 days

P. falciparum smear positive within one month after starting treatment

Treatment:
Refer page 7.
Chloroquine for 5 days
Primaquine one dose

Take blood smear at 7 days

Take blood smear at 28 days

P. falciparum smear positive within one month of starting treatment.

Notify F.S.M.O.
Treatment:
Refer page 7.
Sulfadoxine-pyrimethamine (Fansidar) one dose.
Primaquine one dose.

Take blood smear at 7 days

Take blood smear at 28 days.

3.7 Management of severe and complicated malaria

Patients with severe or suspected severe malaria should be treated in a hospital where constant attention can be provided and laboratory facilities are on hand. BHUs are unable to provide the level of services required and all patients presenting at BHUs must be referred rapidly to a hospital with facilities to manage severe malaria.

The severe manifestations of falciparum malaria include the following; cerebral malaria, convulsions, severe anaemia, jaundice, hemoglobinuria, renal failure, pulmonary oedema, fluid, electrolyte, or acid base disturbance, hyperthermia, hypoglycaemia and bleeding and clotting disorders.

Cerebral malaria frequently results in death especially in young children. The preliminary symptoms and signs of cerebral malaria are many and include headache, stiffneck, drowsiness, disorientation, delirium, convulsions, ataxia and meningeal irritation. A diagnosis of cerebral malaria requires the patient to be comatose and for the blood smear to show falciparum parasites. Cerebral malaria is a medical emergency.

Chloroquine or quinine are usually used in the management of severe malaria. It should be remembered that chloroquine given parenterally, that is intramuscularly or intravenously can be followed by acute toxicity and sudden death, particularly in children. Chloroquine is well absorbed from the gastro-intestinal tract and should be given orally if the patient is able to swallow. It can also be given by nasogastric tube. If it is given parenterally the regimen should be 3.5 mg base/kg repeated 6 hourly.

3.8 Malaria in Pregnancy.

Pregnant women are at increased risk of developing malaria during pregnancy, either from a new infection or from a relapse or recrudescence of previous malaria infection. Their immunity is reduced during pregnancy.

Women attending antenatal clinic should be asked if they have fever or had a fever recently and if they reply yes then a blood smear should be taken.

Adequate treatment for malaria should not be withheld from a pregnant woman for fear of adverse effects of the antimalaria drugs. Chloroquine treatment should be given as soon as possible. Hospitalization should be considered, certainly for severe cases.

Malaria is an important cause of abortions, miscarriages and stillbirths. It also leads to low birthweight infants.

Afghan Refugee Health Programme
Pakistan

Guidelines

Malaria Control

Chief Commissionerate Afghan Refugees
United Nations High Commissioner for Refugees
Islamabad 1990

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MALARIA CONTROL GUIDELINES

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